$$\Delta a/a = (a_d - a_e)/a_c$$

where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure.

2. {UNAMENDED} A light-emitting diode according to claim 1, wherein crystal of the semiconductor substrate is inclined by 8° (8 degrees) to 20° (20 degrees) in a [110] direction with respect to a (100) plane thereof.

3. {UNAMENDED} A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is selected in such a manner that the current diffusion layer becomes transparent with respect to a wavelength of light emitted from the light-emitting structure.

4. {UNAMENDED} A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and x is set in the range of 0.01 to 0.05 and 1-y is set in the range of 0.01 to 0.30 in the composition.

5. {UNAMENDED} A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of 1-y in the composition varies along a thickness direction of the layered structure.

6. {UNAMENDED} A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of 1-y in the composition decreases in a step-like manner along a thickness direction of the layered structure from an interface with the light-emitting structure toward opposite end of the current diffusion layer.

7. {UNAMENDED} A light-emitting diode according to claim 1, wherein a composition of the current diffusion layer is expressed as $(Al_xGa_{1-x})_yIn_{1-y}P$, and at least one of a value of x and a value of 1-y in the composition varies in a step-like manner along a thickness direction of the layered structure from an interface with the light-emitting structure toward opposite end of the current diffusion layer, thereby controlling a resistivity of the current diffusion layer in the thickness direction.

8. {UNAMENDED} A light-emitting diode according to claim 5, wherein both the values of x and 1-y in the composition of the current diffusion layer vary, independent of each other.

9. {UNAMENDED} A light-emitting diode according to claim 6, wherein both the values of x and 1-y in the composition of the current diffusion layer decrease, independent of each other.

10. {UNAMENDED} A light-emitting diode according to claim 7, wherein both the values of x and 1-y in the composition of the current diffusion layer vary, independent of each other.

11. {UNAMENDED} A light-emitting diode, comprising:

a semiconductor substrate; and

a layered structure comprising an AlGaInP type compound semiconductor material provided on the semiconductor substrate, the layered structure comprising:

a light-emitting structure comprising of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and

a current diffusion layer comprising an AlGaInP type compound semiconductor material, the current diffusion layer being lattice-mismatched with the light-emitting structure.

12. {UNAMENDED} The light-emitting diode as in claim 11, wherein a lattice mismatch Δ a/a of the current diffusion layer with respect to the light-emitting structure is defined by

$$\Delta a/a = (a_d - a_c)/a_e$$

where a_d is a lattice constant of the current diffusion layer, and a_c is a lattice constant of the light-emitting structure.

13. {UNAMENDED} The light-emitting device as in claim 12, wherein the lattice mismatch is -1% or smaller.

14. {ONCE AMENDED} A light-emitting diode, comprising:

a semiconductor substrate; and

a layered structure comprising an AlGaInP type compound semiconductor material provided on the semiconductor substrate, the layered structure comprising:

a light-emitting structure comprising a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers;

a current diffusion layer comprising an AlGaInP type material which is lattice-mismatched with the light-emitting structure and the semiconductor substrate; and wherein

the semiconductor substrate is inclined in a [011] direction with respect to a (100) plane thereof.

PLEASE ADD NEW CLAIMS 15 - 16 AS FOLLOWS:

-- 15. {NEW} A light-emitting diode, comprising:

a semiconductor substrate; and

a layered structure comprising an AlGaInP type compound semiconductor material provided on the semiconductor substrate, the layered structure comprising:

a light-emitting structure comprising of a pair of cladding layers and an active layer for emitting light provided between the pair of cladding layers; and

a current diffusion layer comprising an AlGaInP type compound semiconductor material, the current diffusion layer being lattice-mismatched with the light-emitting structure to obtain a prescribed level of resistivity of the current diffusion layer.

16. {NEW} A light-emitting diode according to claim 15, wherein the lattice mismatch Δ a/a of the current diffusion layer with respect to the light-emitting structure defined by the following expression is -1% or smaller:

$$\Delta a/a = (a_d - a_c)/a_e$$

where a_d is a lattice constant of the current diffusion layer, and a_e is a lattice constant of the light-emitting structure.

REMARKS

Favorable reconsideration of the above-referenced application is respectfully requested.

A. SUMMARY OF THIS AMENDMENT

By the current amendment, Applicant:

1. Amends claim 1 to moot the formalities rejections under 35 USC 112, second paragraph.
2. Adds new claim 15 (which resembles claim 11 with a last clause taken essentially from the paragraph bridging pages 19 and 20 of the specification), and new dependent claim 16 (having limitations taken from the end of original independent claim 1)

3. Respectfully traverses all prior art rejections.

B. THE CLAIMS ARE DEFINITE

In the present Office Action, claims 1 and 5-10 are rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Independent claim 1 has been amended to recite a layered structure comprising an AlGaInP type compound semiconductor material rather than "made of" an AlGaInP type compound semiconductor material, therefore departing from the necessity of being exclusively made of AlGaInP type material.

The Examiner contends that it is unclear how to keep the lattice mismatch to be -1% or smaller, as required by claim 1, while varying the fraction of Indium in the current diffusion layer, as required by claims 5-10. However, this contention is respectfully traversed. It is clear to a person skilled in the art that the claims be interpreted to state that the AlGaInP composition is varied along the thickness direction, in accordance with claims 5-10, in such a way that the lattice mismatch remains within the limits of -1% or less, as given by the equation stated in claim 1.

C. THE PATENTABILITY OF THE CLAIMS

Claims 11 and 14 stand rejected under 35 USC §102(e) as being anticipated by U.S. Patent 5,8147,839 to Hosoba. Claims 1, 3 and 12-13 stand rejected under 35 USC §103(a) as being unpatentable over U.S. Patent 5,8147,839 to Hosoba. All prior art rejections are respectfully traversed for at least the following reasons.

Independent claims 1, 11 and 14 recite that a current diffusion layer comprising an AlGaInP type material is lattice-mismatched with the light emitting structure. It is expressly stated in the present specification that the lattice mismatching is generated between the AlGaInP current diffusion layer and the underlying light-emitting layer

structure by decreasing the In mole fraction of the current diffusion layer (page 19). The advantage of this feature is that the resistivity of the current diffusion layer can be prescribed at the same level as that of the conventional AlGaAs current diffusion layer.

In the 35 USC §102 and §103 rejections, the Examiner contends that U.S. Patent 5,814,839 to Hosoba discloses a current diffusion layer being lattice mismatched with the light emitting structure. However, this is neither taught nor suggested in Hosoba. Hosoba describes that the current diffusion layer is made of AlGaAs or AlGaInP (col. 40, lines 60-62) and that for the current diffusion layer, the composition ratio and material can be changed in the same way as in the active layer, i.e. the Al composition is changed (col. 40, lines 14-34).

However, there is no mention in Hosoba of a lattice mismatch between the layers, which is achieved by varying the In content of the AlGaInP composition. On the contrary, Hosoba discloses that "the current diffusion layer and the substrate are allowed to have satisfactory crystallinity without any strain" (col. 12, lines 46-53), and in all given examples of Hosoba the In mole fraction of the AlGaInP material is given as 0.5, which lattice matches with the substrate (see page 15, lines 15-16 of the present specification).

In the 35 USC §103 rejections, the Examiner then agrees that Hosoba does not explicitly teach a lattice mismatch of the current diffusion layer and light emitting structure of -1% or smaller, but contends that it would have been obvious for one of ordinary skill in the art to discover the optimum or working ranges involved. This is totally unfounded as it is well know in the art that lattice mismatching is undesirable, since it causes an increase in resistivity. Therefore, a person skilled in the art would have no impetus to use lattice mismatching of layers in order to decrease resistivity.

Thus, as lattice mismatching is taught away from in both Hosoba and the Applicants' disclosed related art, which is similar to Hosoba, even if a semiconductor

light-emitting diode with an AlGaInP light emitting structure and an AlGaInP current dispersion layer with the underlying light-emitting structure whilst providing low resistivity as in the present invention.

D. MISCELLANEOUS

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made**."

In view of the foregoing and other considerations, the Examiner has ample bases for withdrawing all rejections and for allowance of all pending claims. Accordingly, a formal indication of allowance is earnestly solicited.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

NIXON & VANDERHYE P.C.

April 22, 2002

By: _____

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